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AN ABSORBENT ARTICLE THAT INCLUDES A LIQUID BARRIER WITH IMPROVED SEALING

Field of the Invention

The present invention relates to absorbent articles, such as diapers or incontinence guards, that provide a better sealing effect against the wearer's skin than earlier known articles of this kind. The invention also relates to a method of producing such articles.

An absorbent article of the kind to which the invention relates will include a liquid-impermeable sheet which is intended to lie distal from the wearer in use, an absorbent body, and an upper liquid-permeable sheet which lies proximal to the wearer in use. When the absorbent article concerned is a diaper or an incontinence guard, the article will also include flexible side flaps or wings that extend laterally beyond the absorbent body on both sides thereof and elastic devices that extend longitudinally along the free side-edges of the side-flaps at least within that part which is intended to form the crotch part of the article in use, said flaps and elastic devices enabling the absorbent article to be fitted to the wearer. These elastic devices function as leg elastic when the article is worn. Thus, when the article is donned, the elastic elements will be stretched and hold the side flaps tightly against the wearer.

Background of the Invention

Present-day absorbent articles have a very high absorbency and can also retain liquid under pressure. The greatest problems occur in the event of rapid liquid discharges. In such cases, it is necessary for a large volume of liquid to pass first through the top liquid-permeable sheet and then be absorbed by and dispersed in the absorbent body. This does not take place instantaneously. The time taken for the liquid to pass through the top sheet may be from about one to two minutes, during which time liquid will run out to the edges of the article and leak therefrom. These problems are addressed with the aid of so-called liquid barriers or inner cuffs or side-flaps that are intended to resist liquid leakage in the event of rapid liquid discharges. The originally used cuffs were intended primarily to retain faeces and

were formed by folding a part of the liquid-permeable top sheet around an elastic thread. In recent times, manufacturers have begun to produce the cuffs from a liquid-impervious material so as to also retain liquid.

When the leg elastic on the absorbent article is stretched and the article fastened on the wearer, the elastic element of the liquid barriers will also be stretched, thereby raising the barriers up. The elastic element of the barriers will hold the barrier edges under tension against the wearer. The upstanding liquid barriers then form beneath the wearer a "trough" in which a rapidly discharged large volume of urine can be accommodated during the time required for the liquid to pass through the top liquid-permeable sheet. Attempts to improve the effectiveness of such liquid barriers have hitherto been directed towards the use of denser materials and towards flaps of sufficiently large size.

One drawback, however, is that liquid will rise above the brim of the barriers and leak out when the volume of liquid discharged is excessive or when the wearer sits or lies so as to press together the space between the upstanding liquid barriers.

Thus, current absorbent articles, such as diapers or incontinence guards, may include along the outer longitudinal edges of the article sealing edges that are intended to lie tightly around the wearer's thighs and shape the article to the wearer's body, as well as a pair of inner cuffs or liquid-barriers which lie inwardly of the outer longitudinal edges and which are intended to form an impervious barrier against rapidly discharged liquid that is not absorbed immediately by the absorbent body of said article. These inner cuffs shall thus be capable of withstanding a relatively high liquid pressure over a limited period of time of the order of a minute or so. The liquid has been absorbed by the absorbent body when this time period has lapsed. Also available are articles which include transverse cuffs that seal-off the transverse edges of the absorbent body.

Absorbent articles which lack the aforedescribed inner liquid barriers are also available. In such cases, the outer longitudinal sealing edges form the sole liquid barriers of the absorbent body.

Also available are absorbent articles which include a liquid-impermeable sheet that is intended to lie proximal to the wearer in use and that includes elastic threads for shaping the article to the wearer's body. This liquid-impermeable sheet includes at least one aperture for register with the wearer's anus and urethra orifices. Elastic is provided around at least a part of the circumference of the aperture or apertures so as to shape the edges of the aperture to the wearer and to form a seal. Situated beneath the liquid-impermeable sheet is an absorbent body which is enclosed between a liquid-permeable sheet and a liquid-impermeable sheet, such that the absorbent body will hang down beneath the wearer with the liquid-impermeable sheet lying distal therefrom.

The inner cuffs are comprised partly of a thin barrier sheet of essentially liquid-impervious inelastic material, e.g. nonwoven, and partly an elastic device which puckers that edge of the liquid barrier which lies against the wearer. The unresilient and inelastic material is fastened along one longitudinal edge either to the top liquid-permeable sheet of the absorbent article so that no liquid can pass between the two sheets, or to the bottom liquid-impervious sheet along a side edge of the article. The elastic device is fastened along the other edge of the unresilient material, so as to gather the liquid barrier together and therewith form a puckered edge, which will be extended partially when the article is donned. Puckering of this edge is normally achieved with an elastic thread placed in a channel in the inelastic material, said channel being formed by folding over and welding one edge of the material. When the absorbent article is donned, the puckered edge will be stretched partially, the extent of this stretch being dependent on the size of the wearer and how the article is donned.

The described liquid barriers or leg elastic cannot be used in absorbent articles held against the body of the wearer by special elastic pants or panties. These absorbent articles may comprise other sealing edges which are not streched and held tensioned against the body. Thus, EP-A1-0 534 488 describes sealing gaskets which are preformed to extend outward from the central part of an absorbent article, which is illustrated by a sanitary napkin in the description of the preferred embodiment. The gaskets may be formed by looping a strip of material, such as a non-woven material, so as to form a compliant cuff which bears against the user's body in a comfortable manner. In one embodiment the gaskets are attached directly to the edges of the absorbent article, one edge of the gasket strip being attached to the upper sheet of the absorbent article and the other edge to the lower sheet. The looping of the material form cavitities for imparting compliancy and stability to the gaskets and the looping may also enclose elastic elements that are placed in tension when applied to the article so as to impart an arcuate shape to the article.

In another embodiment the gasket material is an elastic material which is attached to the longitudinally edges of the sanitary napkin. The material is placed in tension when applied to the sanitary napkin. The purpose of doing so is to impart an arcuate shape to the article.

The sanitary napkin is placed in a panty crotch during use and is pressed against the wearer by the force from the panty. Thus, the force applied from the sanitary napkin against the wearer is indirectly caused by pressure from the panty. The gasket embodiments including elastic elements do not cause the force against the body of the wearer. The purpose of the elastic elements are, if they are used, to impart an arcuate shape. This differs from the diaper or incontinence guard according to the invention with a barrier element including an elastic device, wherein the barrier element will get stretched against the wearer during use and thereby creating a liquid barrier with a good sealing effect. It is the body of the user which makes the elastic device in the barrier to get tensioned.

Summary of the Invention

Another type of sealants are described in US-A-5 445 627. A sanitary napkin is provided with a pair of elastically stretchable flaps adjacent transversely opposite side edges. The flaps are in the form of straps and rising from a backsheet. Adhesives are applied on the top surface of said flaps so that the flaps may be adhesively fastened to the user's skin. The intention is to compensate for a shift of the basic body of the napkin relative to the wearer's body. Thus, the napkin is made to adhesivly adhere to the user's skin. This is not a case where an elastic barrier element is stretched against the wearer to obtain a good sealing effect.

The object of the present invention is to provide a method of improving the ability of an absorbent article comprising leg elastic to remain tight against a wearer, with the aid of various measures. Another object of the invention is to provide an absorbent article comprising leg elastic and having improved sealing properties with respect to the wearer of the article.

Brief Description of the Drawings

The invention will now be described with reference to the accompanying drawings, in which

Figs. 1a, b, c illustrate measuring equipment used to determine the leakage pressure or breakthrough pressure for an elastic barrier material. Fig 1a shows the equipment without any applied material, Fig 1b shows the equipment with material applied in a stretched state, and Fig. 1c is a principle illustration of how the leakage pressure is determined;

Figs. 2a, b illustrate schematically a pore in a liquid barrier and the principle of determining the weighted mean value cos θm and determining the radius r;

Fig. 3a illustrates a conventional diaper or incontinence guard with upstanding liquid barriers;

Figs. 3b, c are enlarged principle views of a section through the region B in Fig. 3a, firstly with respect to a conventional diaper (3b) and secondly for an embodiment of the invention (3c);

Figs. 4a, b illustrate the principle of calculating the available elongation or stretch;

Fig. 5a is a graphic illustration showing the measured breakthrough pressures for three different liquid barriers;

Fig. 5b is a comparison diagram illustrating calculated and measured breakthrough pressures for the best liquid barrier in Fig. 5a, at different available degrees of elongation;

Fig. 5c is a diagrammatic illustration of lowest breakthrough pressures for liquid barriers constructed in accordance with the invention;

AMENDED SHEET

Fig. 6a is a graphic illustration of the measured breakthrough pressures for a conventional upstanding liquid barrier on the one hand and for two embodiments of the invention on the other hand;

Fig. 6b is a comparison diagram illustrating calculated and measured breakthrough pressures at different available elongations for one of the inventive embodiments shown in Fig. 6a;

Fig. 7 illustrates the measured breakthrough pressures for a conventional upstanding liquid barrier on the one hand and for a further embodiment of the invention on the other hand;

Figs. 8-14 are reproductions of photographs taken with an electron microscope of different liquid barriers at different available elongations; and

Figs. 8a-12a are views corresponding to the photograph reproductions in Figs. 8-12.

Detailed Description of the Invention

An absorbent article, such as a diaper, is manufactured for use by persons of different sizes. This is achieved by gathering together, or puckering, liquid barriers and side-edges with the aid of elastic. These liquid barriers and side-edges will stretch to different extents in accordance with the size of the wearer, and the tension around the edge of the barrier will thus vary in dependence on the size of the wearer.

Tension in the barrier elastic can be expected to have significance in studies on the sealing property of a liquid barrier, and consequently the extent to which the barrier is stretched will also be significant. A significantly stretched barrier will exert significant tension against the wearer's skin and can be expected to provide a better seal than corresponding barriers that are stretched to a lesser extent. One wish in this respect has been to produce the highest possible tension in the liquid barrier and therewith obtain the best possible sealing effect. However, it is not possible to use elastic in which the tension is excessively high, since the absorbent article will then be uncomfortable to wear and leave marks in the skin.

The term “available elongation or stretch” can be used when considering the extent to which a liquid barrier is stretched.

In the manufacture of the absorbent article, e.g. a diaper, the elastic material, which has a given degree of stretchability, is "locked" firmly to remaining non-stretchable material, normally nonwoven. The extent to which the elastic material is stretched in the manufacture of the article cannot be exceeded when the article is in use, since the elastic material is firmly secured to a non-stretchable material. This is shown in Fig. 4a. The elastic material has the length **L** at this point.

The non-stretchable material to which the elastic material is locked is puckered somewhat when the diaper is placed on the wearer's body. The elastic material has then contracted to the smaller length **Lx.**

The available stretch or elongation **X** is the extent to which the material can be stretched from the user state to the maximum stretched state of the product. This can be expressed by the formula: **L = Lx ((X/100) + 1)**, where **X** is the available stretch or elongation in percent.

Test equipment was constructed with the intention of studying the sealing effect achieved between a liquid barrier or some other puckered barrier and the wearer's skin. This equipment is shown in Figs. 1a, 1b and 1c and comprises a Plexiglas stand which includes a base plate **a** and an upstanding support plate **b**. A first upwardly open, semi-cylindrical element 1 is fastened horizontally to the upstanding support plate **b** and has around its periphery a scale which denotes the available elongation or stretch. One end of the semi-cylindrical element is attached to the support plate while the other end has an end-wall 1'. Provided at the very bottom of the semi-cylindrical element 1 is a hole 2 to which a vertically upstanding filling tube 3 and an inclined measuring tube 4 lead, both of said tubes having a scale expressed in mm water. The equipment also includes a loose second semi-cylindrical element 5 whose diameter is somewhat larger than the diameter of the

first semi-cylindrical element 1 and which has one side open and an end-wall 5' at its other end.

As shown in Fig. 1b, a measuring operation is carried out by securing a liquid barrier around the outer periphery of the first semi-cylindrical element and fastening said barrier around the upper edges. The elastic part 7 is directed towards the attachment of the semi-cylindrical element to the support plate **b**, and the liquid barrier material is folded around the end-wall 1' of the first semi-cylindrical element 1 on the other side. The elastic part is fastened along the scale on the semi-cylindrical element so as to enable the available elongation or stretch to be read-off. The end-wall 5' of the second semi-cylindrical element 5 is placed against the end-wall 1' of the first semi-cylindrical element with said upfolded part of said barrier material located therebetween and pressed thereagainst with the aid of a clamp 10, such as to obtain a small clearance 9 between the cylindrical walls. Synthetic urine is introduced through the vertical tube 3. The liquid barrier is first weighted down so as to fill the clearance between the semi-cylindrical elements. A liquid pressure is thereafter built-up against the elastic edge 7 at the same time as a liquid column is formed in the tubes 3, 4, where the pressure can be read-off. Liquid is introduced until leakage occurs at arrow B (Fig. 1c) at the breakthrough pressure.

Three available types of liquid barriers, Huggies standing gather, Pampers standing gather and Peaudouce leg elastic, have been studied with this equipment, the leakage tendency with the elastic element stretched to and locked at different available elongations being measured. The liquid pressure at which leakage will occur in respect of a barrier stretched to a given extent, i.e. a barrier that has a given available elongation or stretch, has been determined with the aid of the test equipment, this pressure being found to vary in dependence on the extent to which the puckered edge is stretched. The measured values are shown in the diagram in Fig. 5a. As will be evident from the Figure, however, different barriers give different breakthrough pressures at the same available stretch or elongation. It thus

appears that the sealing effect is influenced by other factors than solely the tension in the elastic material.

The invention is based on an attempt to provide an improved sealing effect on the basis of factors other than the actual tension in the elastic.

On the basis of the theory that leakage does not occur merely because the elastic in the barrier material releases its contact with the wearer's skin but first occurs through the through-penetrating pores or channels that are formed between the wearer's skin and the folds in the puckered edge of the barrier material, endeavours have been made to create a model from which the leakage pressure can be determined theoretically and thereby become aware of those parameters that shall be influenced in order to achieve a better sealing effect.

The capillary pressure of the pores in porous structures can be calculated with the Laplace equation.

According to Laplace, the capillary pressure $\Delta P = 2\gamma \cos\theta / r$, where γ is the surface tension of the liquid, θ is the wetting angle of the liquid to the material in the capillary walls, and r is the radius of the capillary. When θ is greater than 90°, $\cos\theta$ is negative and ΔP is consequently also negative. The capillary wall is hydrophobic and the resultant pressure ΔP can be said to describe the breakthrough pressure, i.e. the maximum pressure a capillary or pore can withstand. When θ is less than 90°, the capillary wall is hydrophilic and ΔP and $\cos\theta$ are positive. Liquid is then "sucked" into the pores.

When studying the pressure in a capillary or pore, where the wall consists of several materials, such as in a pore formed between skin and a fold in a liquid barrier, the proportion of circumference of each material must be weighed together so as to

provide a mean value of cosθ, hereinafter designated cosθm. The breakthrough pressure will then be $\Delta P = 2\gamma \cos\theta m/r$.

In the present case, the walls of the pores consist partly of an hydrophilic material, i.e. skin, which has a wetting angle of less than 90°, and partly of the hydrophobic material in the liquid barrier, which has a wetting angle above 90°. Cosθm is the weighted mean value of the pore wall's cosθ-values and is calculated in the manner illustrated in Fig. 2a, where A designates the circumference proportion hydrophobic wall and B designates the circumference proportion hydrophilic wall, where $A + B = 1$. Cosθm will therewith equal $A\cdot\cos\theta_{fob} + B\cdot\cos\theta_{fil}$.

As described below, trials have been carried out with the intention of checking whether or not the described model can be used as a basis on which the breakthrough pressure can be evaluated.

The wetting angle of the skin varies in accordance with the state of the skin, i.e. whether the skin is clean or dirty, for instance. Measuring equipment comprised of Plexiglas with a wetting angle of 77°, which lies close to the mean value of the wetting angle of the skin (about 74°), was used for comparison purposes. Measurement were carried out on the commercial liquid barrier that produced the best sealing result according to Fig. 5a, i.e. Huggies standing gather which has a wetting angle of 120°. The liquid used was synthetic urine. γ is the surface tension of synthetic urine, i.e. 0.06 N/m.

Abutment of a liquid barrier against the measuring equipment was studied at different available elongations with an electron microscope, enlargement 130 times, as illustrated in Figs. 8-12 and Figs. 8a-12a. As will be evident from the Figures, a through-penetrating pore is formed between the threads or fibres of the barrier material and the Plexiglas wall of the test equipment. This pore is assumed to

function as a capillary, where r = the radius of the largest possible circle that can be enclosed in the channel, as evident from Fig. 2b.

The through-penetrating pore has been drawn in Figs. 8a-12a. The following pore-radius values were obtained at different available elongations, as shown in the Figures.

Available Elongation	Pore Radius
10%	0.0208 mm
20%	0.0812 mm
30%	0.1208 mm
40%	0.1458 mm
50%	0.1458 mm

Comments: It was very difficult to measure the pore radius on the photograph at a 10% available elongation, and the value given is therefore perhaps unreliable.

The crosses shown in Figs. 8a-12a show the lateral terminal points of the pore intended for calculating the hydrophobic and hydrophilic length-proportions of the pore. The length ratio between hydrophobic and hydrophilic surfaces in the pore at different available elongations is shown in the following Table.

Avail. elong	Hydrophil. surface	Hydrophob. surface
10%	39%	61%
20%	39%	61%
30%	32%	68%
40%	39%	61%
50%	50%	50%

Calculations relating to “Huggies standing gather” against Plexiglas:

10% available elongation

$\Delta P = 2\cdot 0.06\cdot(0.39\cdot\cos 74° + 0.61\cdot\cos 120°)/0.0208\cdot 10^{-3}$

ΔP = -1139 Pa => the absolute value of the breakthrough pressure = 114 mm H_2O

20% available elongation

$\Delta P = 2\cdot 0.06\cdot(0.39\cdot\cos 74° + 0.61\cdot\cos 120°)/0.0812\cdot 10^{-3}$

ΔP = -291.9 Pa => the absolute value of the breakthrough pressure = 29.2 mm H_2O

30% available elongation

$\Delta P = 2\cdot 0.06\cdot(0.32\cdot\cos 74° + 0.68\cdot\cos 120°)/0.1208\cdot 10^{-3c}$

ΔP = -250.1Pa => the absolute value of the breakthrough pressure = 25.0 mm H_2O

40% available elongation

$\Delta P = 2\cdot 0.06\cdot(0.39\cdot\cos 74° + 0.61\cdot\cos 120°)/0.1458\cdot 10^{-3}$

ΔP = -162.6 Pa => the absolute value of the breakthrough pressure = 16.3 mm H_2O

50% available elongation

$\Delta P = 2\cdot 0.06\cdot(0.5\cdot\cos 74° + 0.5\cdot\cos 120°)/0.1458\cdot 10^{-3}$

ΔP = -92.3 Pa => the absolute value of the breakthrough pressure = 9.2 mm H_2O

Fig. 5b shows a comparison between the breakthrough pressures measured with the test equipment and the breakthrough pressures calculated with the above formula.

Since the calculated and measured breakthrough pressures are in good agreement, it is thus possible to improve the sealing effect of the liquid barrier in an absorbent article against the wearer's skin by influencing $|\Delta P|$, i.e. $|(2\gamma \cos\theta m/r)|$, of the barrier so that this value increases. One provision in this respect is that the tension in the elastic will be sufficiently high to prevent the liquid barrier from allowing liquid to escape at a lower pressure as a result of the elastic relaxing and allowing

the barrier to "ease" away from the wearer by virtue of the liquid column weighing down the barrier so that it releases its contact with the abutment surface.

$|\Delta P|$ can be caused to increase by increasing the product $|(2\gamma \cos\theta m/r)|$

The invention thus relates to a method of improving the sealing ability of an absorbent article by causing the product $-(2\gamma \cos\theta m/r)$ of one or more of the liquid barriers of the article to increase.

The product can be increased by, for instance
1) influencing the wetting angle between the liquid to be sucked up and the skin or the barrier material, respectively;
2) influencing the pore radius, i.e. the capillary radius, formed between the barrier material and the skin; and
3) influencing both wetting angle and pore radius.

Because the effect intended is to increase the absolute value of the product $2\gamma \cos\theta m/r$, it is not necessary to unilaterally increase $|\cos\theta m|$ or decrease r. It is possible for a procedure of increasing $|\cos\theta m/r|$ to also involve simultaneous increase of the radius. Provided that the increase in $|\cos\theta m|$ is proportionally greater than the increase in radius, an improved result will be obtained despite the increase in radius. Similarly, a procedure that decreases the radius may result in a decrease in $|\cos\theta m|$. An improved result will still be achieved, however, provided that this latter decrease is proportionally smaller than the decrease in radius.

The invention also relates to an absorbent article such as a diaper or an incontinence guard that has improved sealing properties against a user and which has been produced so that in the case of at least a pair of the liquid barriers of the article, the absolute value of the product $2\gamma \cos\theta m/r$ will be higher than that obtained when using earlier known absorbent articles. More specifically, during the greater part of

the interval 20-40% available elongation or stretch, preferably during the major part of the interval between 15 and 50%, and particularly during the major part of the interval between 10 and 80% available elongation, the absolute value y of the product $2\gamma \cos\theta m/r$ will lie above line y=kx+m, where x designates the available elongation or stretch, k has the value -14/30 and m has the value 48 (line 1), preferably 51 (line 2), more preferably 57 (line 3) and even more preferably 63 (line 4) and in particular 69 (line 5). These lines are shown in Fig. 5c, in which the measured breakthrough pressure of the most effective liquid barrier known at present, i.e. the Huggies standing gather barrier, has been drawn by way of comparison.

The invention will now be described in more detail with reference to particular exemplifying embodiments and also with reference to the accompanying drawings.

Examples

Fig. 3a shows a conventional diaper or incontinence guard 20 which includes a liquid-permeable top sheet 22, an absorbent sheet 23, and a liquid-impermeable bottom sheet 21, said sheets being delimited by two transverse edges 24, 25 and two longitudinal edges 26, 27. The illustrated article also includes longitudinally extending leg elastic 28 and an upstanding liquid barrier 29 on each side of the longitudinal centre line. Fig. 3b is a sectional view that illustrates the construction of the upstanding liquid barrier comprising a liquid-impermeable sheet 12 whose free edge is curved around two stretched elastic threads 13. The threads 13 function to pucker the sheet 12.

Fig. 3c illustrates an embodiment of the invention in which the pore radius has been significantly reduced, and is constant and small already at high available elongation or stretch. In this case, the elastic threads 13 have been replaced by an elastic film

14. This film will lie essentially smoothly against the skin. The pore radius is close to 0 already at a high available elongation.

Fig. 14 is a reproduction of an electron microscope photograph of an inventive embodiment similar to the embodiment of Fig. 3c, in which an elastic film is used as the edge on the liquid barrier, stretched against the Plexiglas. The small pores that can be seen are the result of the film being a three-ply film in the illustrated case, where only the centre layer is elastic. The outer layers used to join the film to the barrier will crack when the centre layer is stretched, as shown in Fig. 15. The visible small pores, which have a radius of about 0.02 mm, will remain essentially constant irrespective of the available elongation, since the height of the pores is constant even though the length is changed. The uppermost curve in Fig. 7 illustrates measurements made with this liquid barrier. The lower curve shows the results obtained with a Huggies standing gather.

The wetting angle was changed in two tests. In the first case, a plastic film having a wetting angle of 97.5° was stretched over the first semi-cylindrical Plexiglas surface. This corresponds to a treatment of the barrier such that the wearer's skin will obtain a higher wetting angle. This is hydrophobic in distinction to the normal skin mean wetting angle of about 74°. The result of this change in the wetting angle (centre curve) is compared in Fig. 6a with the sealing effect achieved with the upstanding liquid barrier Huggies standing gather (lowermost curve). As the measuring values show, an improved sealing effect is achieved in this way.

The uppermost curve in Fig. 6a shows measurements obtained with a liquid barrier that had been treated with Vaseline. Vaseline has a wetting angle of 100°. The Vaseline partially blocks the pores, i.e. reduces the pore radius, and also smears the wearer's skin, thereby increasing the wetting angle of the liquid to the skin. As will be evident from the diagram shown in Fig. 6a, there is obtained a significant improvement that exceeds the improvement achieved when only the wetting angle of the skin is changed, despite obtaining, at the same time, a reduction in the wetting

angle of the barrier by virtue of the Vaseline also smearing the liquid barrier and therewith lowering its wetting angle from 120° to 100°.

Fig. 6b is a diagram in which the calculated and measured sealing effects obtained when changing the wetting angle are shown. The measured values have been obtained by covering the Plexiglas with the aforedescribed plastic film, and corresponds to the centre curve in the diagram shown in Fig. 6a. Good agreement is obtained between the calculated and measured values.

As will be evident from the aforegoing, the sealing effect provided by an absorbent article can be improved by treating at least one of its liquid barriers in a manner such as to cause the absolute value of the negative product $2\gamma \cos\theta m/r$ to increase at least within the major part of an available elongation range of 20-40%. The sealing effect of an article having a liquid barrier where the absolute value of the negative product $2\gamma \cos\theta m/r$ lies above the line $y=kx+m$ at least within the major part of an available elongation range of 20-40%, where x designates the available elongation or stretch, k has the value -14/30 and m has the value 48, preferably 51, more preferably 57, and even more preferably 63 and particularly 69, will be substantially better than the sealing effect achieved with conventional articles of this nature.

The invention also relates to articles that have transverse liquid barriers, and to a method of treating such liquid barriers in the same manner as that described with respect to the longitudinally extending liquid barriers.

The longitudinally extending liquid barriers may be comprised of both leg elastic and inner cuffs.

It will be understood that the invention is not restricted to the described exemplifying embodiments thereof and that it includes all conceivable embodiments that lie within the scope of the following Claims.